

REMARKS

Claims 1-6, 17-19, 40-42, 44-46, 48, 49, and 51-62 were pending in the above-identified application when last examined. Claims 1, 2, 5, 6, and 51-62 stand rejected and the rejection was made final. Applicants request entry of the above amendment which is being submitted with a request for continued examination under 37 CFR § 1.114.

Claims 1, 2, 5, 6, 59, and 60-62 were rejected under 35 U.S.C. § 102(b) as anticipated by U.S. Pat. No. 5,202,567 (Hamanaka). Claims 5 and 59 are canceled. Applicants respectfully traverse the rejection of claims 1, 2, 6, and 60-62.

Claim 1 distinguishes over Hamanaka by reciting, “a first circuit unit integrated on a first chip containing a first electronic circuit and a plurality of modulators, wherein: ... each modulator is controlled by a corresponding one of the electrical output signals and is capable of modulating a corresponding component of a first optical signal.” Claim 1 further distinguishes over Hamanaka by reciting, “a second circuit unit integrated on a second chip containing a second electronic circuit and a plurality of detectors, wherein: ... each detector is capable of detecting modulation of a corresponding one of the components of the first optical signal to extract corresponding one of the input signals.” Hamanaka fails to disclose or suggest systems including an electronic circuit unit and a plurality of modulators or detectors on a chip.

Hamanaka discloses systems for optical transmission of information between circuit boards. Claim 1 by reciting “a first chip containing a first electronic circuit and a plurality of modulators” distinguishes from the structure of Hamanaka where electronic circuits are on separate chips mounted on a circuit board. For example, Fig. 1 of Hamanaka shows an optical input/output port 3 and several electronic circuits 4 on a circuit board 11. Further, Hamanaka fails to suggest integrating such structures on a chip because Hamanaka fails to indicate or suggest that input/output port 3 is suitable or adaptable for use in a chip. More specifically, Hamanaka discloses systems employing arrays of pixels or rod lenses for spatially separated optical signals but does not provide any guidance or suggestion to one of skill in the art regarding whether or how such structures could be integrated in a chip.

Instead of suggesting a chip-to-chip connection, Hamanaka, in describing the field and summary of the invention, specifically discloses that the invention is directed at optically interconnecting electronic circuit boards. See the “Field of the Invention” of Hamanaka. Hamanaka indicates that interconnection problems were present in other

settings. In particular, Hamanaka at column 1, line 20-23 acknowledges the problems caused by the “limitations posed by the nature of electric circuitry itself on interchip interconnections, chip-to-chip interconnections, and board-to-board interconnections,” but Hamanaka only provides a solution for the problem at the board-to-board level.

Accordingly, claim 1 is patentable over Hamanaka.

Claims 2, 6, 60, and 61 depend from claim 1 and are patentable over Hamanaka for at least the same reasons that claim 1 is patentable over Hamanaka.

Claim 62 is amended to independent form but is otherwise of the same scope previously considered. Claim 62 distinguishes over Hamanaka at least by reciting, “the first and second circuit units are integrated in a chip, and the first optical signal propagates from the first circuit unit to the second circuit unit within the chip.” As noted above, Hamanaka is directed to optical communications between circuit boards. Hamanaka fails to disclose or suggest an optical signal that “propagates from the first circuit unit to the second circuit unit within the chip,” for example for inter-chip communications.

Accordingly, claim 62 is patentable over Hamanaka.

For the above reasons, Applicants request reconsideration and withdrawal of the rejection under 35 U.S.C. § 102.

Claims 51-58 were rejected under 35 U.S.C. § 103(a) as unpatentable over U.S. Pat. App. Pub. No. 2002/0009277 (Noda). Applicants respectfully traverse the rejection.

Claim 51 distinguishes over Noda at least by reciting, “An integrated circuit, comprising: an circuit capable of processing a plurality of electrical signals; a waveguide for an optical signal that includes a plurality of frequency components ...; and a plurality of electrical elements ... wherein the plurality of electrical elements respectively implement transformations between the frequency components and the respective electrical signals of the circuit.”

Noda is directed to waveguides and wavelength demultiplexers and primarily describes 2-D photonic crystal structures. In paragraph [0065], Noda does indicate that “the photonic crystal structure may be integrated with semiconductor devices having a photoelectric conversion function, for example, photodiode arrays 45 to 47 as shown in FIG. 8.” However, Noda fails to disclose or suggest including such a structure in an integrated circuit containing a circuit capable of processing the electronic signal. In accordance with an aspect of Applicants’ invention, the number of pins and the area and size of an input or output interface of an integrated circuit can be reduced through use of multi-frequency optical signal and waveguide. Noda does not disclose such an integrated

structure because Noda is primarily concerned with the optical structures, and while Noda describes that demultiplexed optical signals can be converted to electrical signals, Noda fails to suggest to one of skill in the art that such a structure could beneficially be included in an integrated circuit as an input or output interface. Accordingly, claim 51 is patentable over Noda.

Claims 52-58 depend from claim 51 and are patentable over Noda for at least the same reasons that claim 51 is patentable over Noda.

Claim 58 further distinguishes over Noda by reciting, “each of the electronic elements comprises a modulator that is controlled by a corresponding one of the electrical signals and modulates the frequency component that the associated resonator feeds into the waveguide.” Noda fails to disclose or suggest modulators.

For the above reasons, Applicants request reconsideration and withdrawal of the rejection of claims 51-58 under 35 U.S.C. 103(a).

Claims 3, 4, 41, 42, 44-46, 48, and 49 were objected to as dependent upon a rejected claim but were indicated as allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims. Claims 3, 4, 46, 48, and 49 are amended to independent form including the limitations of prior base claim 1. Claims 41, 42, and 45 now depend from claim 3 and no longer depend from a rejected claim. In view of the above amendments, Applicants request reconsideration and withdrawal of the objection to claim 3, 4, 41, 42, 44-46, 48, and 49.

Claims 17-19 and 40 stand allowed.

In summary, claims 1-6, 17-19, 40-42, 44-46, 48, 49, and 51-62 were pending in the application when last examined. The above amendment cancels claims 5 and 59 and amends claims 1, 3, 4, 6, 44, 46, 48, 49, 51-58, 60, and 62. For the above reasons, Applicants respectfully request continued examination of the above-identified patent application, entry of the above amendment, withdrawal of the final rejection, and allowance of the application including claims 1-4, 6, 17-19, 40-42, 44-46, 48, 49, 51-58,

PATENT LAW OFFICES OF
DAVID MILLERS
6560 ASHFIELD COURT
SAN JOSE, CA 95120
PH: (408) 927-6700
FX: (408) 927-6701

and 60-62. Please contact the undersigned attorney at (408) 927-6700 if there are any questions concerning this document.

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Respectfully submitted,



David Millers
Reg. No. 37,396

PATENT LAW OFFICES OF
DAVID MILLERS
6560 ASHFIELD COURT
SAN JOSE, CA 95120
PH: (408) 927-6700
FX: (408) 927-6701